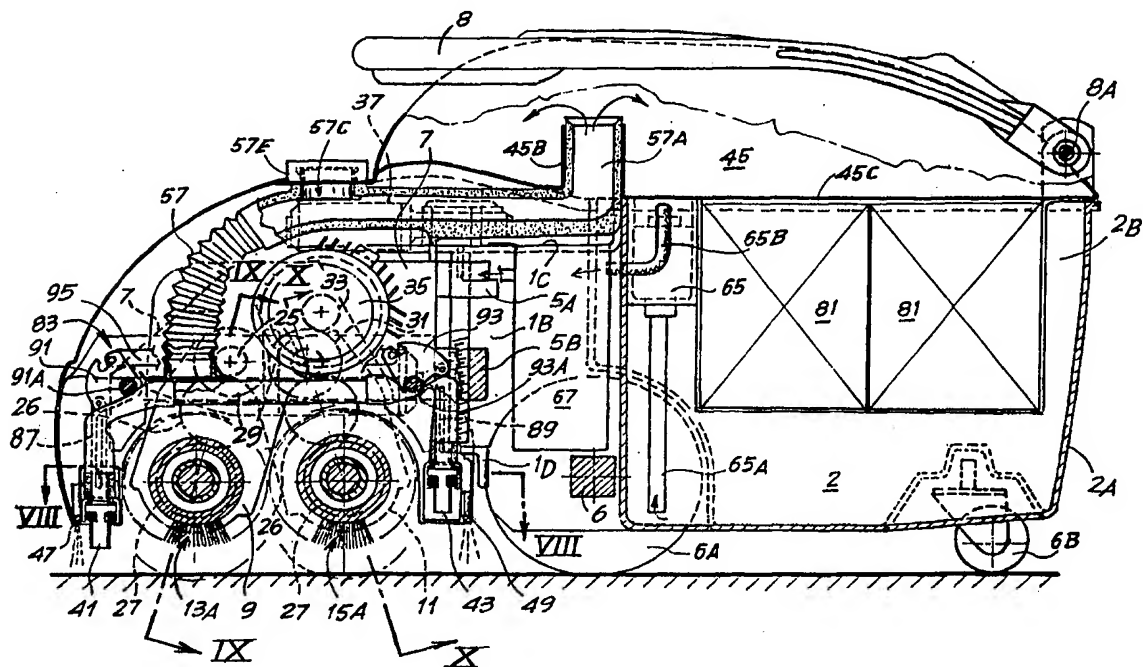




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(54) Title: A MACHINE FOR THE WET CLEANING OF FLOORS



(57) Abstract

The invention comprises a system for dispensing cleaning water having a dispensing pump (65) and a unit (67) for heating the dispensed water, so that heated or unheated water and/or steam is dispersed through jets (47, 49) onto the surface to be cleaned.

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A MACHINE FOR THE WET CLEANING OF FLOORS

DESCRIPTION

5 This invention relates to a machine for the wet cleaning of floors by means of cleaning brushes placed in contact with the surface to be cleaned.

 For the cleaning of floors, especially floors with surfaces that are poorly water absorbent, such machines usually comprise a system for
10 dispensing cleaning water taken from a tank mounted on the machine itself for spraying the floor in the vicinity of the brushes, the brushes rotating in such a way that the direction in which each brush rubs the floor is the opposite to that of the other brush of the pair, so that water cannot collect between the brushes. The machine also possesses a system for sucking the
15 water off the floor so as to leave it more or less dry after the passage of the machine. The used water is sucked off the floor by means of nozzles that are placed in contact with the floor upstream and downstream of the set of brushes with respect to the direction of movement of the machine, and are connected to said suction system, which conveys the collected water into a
20 second tank on board said machine, from where it can subsequently be thrown away, or filtered and reused.

 The water dispensing system according to the invention comprises a variable-delivery dispensing pump and a unit for heating the dispensed water so that hot water and/or steam is dispersed onto the surface to be
25 cleaned. In order to make it particularly compact and ready for use, said heating unit may comprise at least one electrical resistor in thermal contact with a coil through which the water is passed, the coil being formed, for example, between two metal plates, to the outsides of which said electrical resistors are applied.

30 The pump may be of the type operated by an electromagnet, in which case the delivery of the pump can be regulated by varying the frequency of the pulses supplied to the electromagnet via an electronic control circuit by means of which the desired frequency can be set.

35 A clearer understanding of the invention will be gained from the description and accompanying drawing, which latter shows a practical and nonrestrictive embodiment of the invention. In the drawing:

 Figs. 1, 2 and 3 respectively show a lateral view of the left-hand side, a lateral view of the right-hand side and a plan view of the machine

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according to the invention, partly in section;

Fig. 4 shows a partial view of a suction circuit for the machine;

Fig. 5 shows a front view on V-V of the suction circuit of Fig. 4;

5 Figs. 6 and 7 show a lateral view and front view on VII-VII (Fig. 6) of a unit for heating the water for spraying on the floor, forming part of the machine;

Fig. 8 shows an enlarged plan view of the set of brushes of the machine of Fig. 1, partly sectioned on a horizontal plane marked VIII-VIII in Fig. 1;

10 Figs. 9 and 10 show enlarged views of the machine of Fig. 1 in section on the planes marked IX-IX and X-X, respectively;

Figs. 11 and 12 show details of a brush in section on vertical planes marked XI-XI and XII-XII, respectively, in Fig. 9;

15 Figs. 13, 14 and 15 show enlarged details of the machine in section on the vertical planes marked XIII-XIII, XIV-XIV and XV-XV, respectively, in Fig. 3;

Figs. 16A, 16B and 16C show detail A of Fig. 15, with a front suction nozzle in three different raised positions; and

20 Figs. 17 and 18 show a lateral view and a plan view, respectively, of a system for raising said suction nozzles.

The machine has a supporting structure (Figs. 2 and 3) consisting essentially of a thick strip of sheet metal 1A bent up at the rear of the machine to support a tank of clean water 2 (see also Fig. 1) having an outer envelope 2A. Said strip of sheet metal 1A is welded at the front end to two
25 vertical plates 1B. These are joined at the top by a horizontal plate 1C and at the bottom by a cross member 1D (Fig. 1) and support an axle 6 at the bottom for two wheels 6A on which the machine is supported. The machine also possesses two casters 6B pivoted to the supporting structure by suitable attachments not shown in the drawing. The machine can thus easily be
30 moved by hand over the floor using a steering handle 8 hinged to the supporting structure by a hinge 8A which allows it to be folded down on top of the machine when the machine is inactive.

The upper plate 1C and the cross member 1D are also connected to each other by two posts 3 (Figs. 3 and 14) whose cylindrical surfaces form
35 vertical guides for two moveable brackets 5A, 5B integral with a plate 7 lying in the vertical sagittal plane of the machine. Fixed on opposite sides of the plate 7 are brackets 9, 11 each carrying a pair of cylindrical brushes 13A, 13B; 15A, 15B on horizontal axes. The brushes of each pair are therefore on

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opposite sides of the plate 7.

Each of said brackets 9, 11 is boxlike and composed of two half shells 9A, 9B; 11A, 11B (Figs. 9, 10) fixed together by screws and pins (not shown in the drawing) and comprises housings for bearings 17, 19 supporting respective power input shafts 21, 22 as well as shafts 23, 24 on which said brushes are mounted. Each bracket 9, 11 contains gearing 25, 26, 27 to connect the power input shafts 21, 22 kinetically to their respective brush shafts 23, 24. Outside said brackets 9, 11, gears 29, 31 are mounted on their respective power input shafts 21, 22 (see also Figs. 1 and 2): these mesh together and gear 31 also meshes with a gear 33 mounted on the shaft of an electric motor 35 that is attached by a flange on its end to the plate 7. The motor 35 can thus turn the shafts 23, 24 and the brushes so as to clean a floor, with reverse rotary movement of the pairs 13A, 13B; 15A, 15B of brushes. Said brushes form, together with their respective gears and the motor and plate 7, a complete assembly that can be raised or lowered on said guides 3 so as to move the brushes toward or away from the surface to be cleaned. A geared motor unit 37 (Figs. 1, 3, 13) mounted on top of the plate 1C can turn a screw 37A in a tapped hole formed in the moveable bracket 5B of the plate 7 so as to move said complete assembly and position it vertically.

The machine includes a sensor of the power drawn by the motor 35 to turn the brushes and a regulating circuit which, on the basis of the power drawn by the motor 35, instructs the actuator 37 to raise the set of brushes from the surface to be cleaned if the power drawn rises, for example when an obstacle is encountered or increased roughness of said surface requiring greater torque, or to lower the set if the opposite happens. Essentially, the machine is provided with a system of regulating the pressure of the brushes on the surface to be cleaned and this system operates in such a way as to maintain constant torque and constant power drawn by the brushes.

Said brushes 13A, 13B and 15A, 15B are mounted cantilever-fashion and project laterally as far as the opposite sides of the machine; both sides of the machine can therefore be placed laterally against walls delimiting the surface to be cleaned, and it is therefore unnecessary to turn the machine around.

The brushes 13A, 13B; 15A, 15B of each pair of coaxial brushes are of unequal lengths and their respective brackets 9, 11 are each nearest the longer brush 15A, 13B (see Fig. 8) of the adjacent pair. In this way, in the

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movement of translation of the machine in the direction of the double arrow F3 all of the surface beneath the machine is brushed by at least one brush, the gaps 13C, 15C between coaxial brushes being staggered laterally relative to each other.

5 In order to permit easy replacement of the brushes, in the invention each brush 13A, 13B; 15A, 15B is connected to its particular part of the supporting shaft 23; 24 by a rapid shaft-hub connection system that can be operated by hand without tools. For the sake of brevity of description we will describe the rapid shaft-hub connection system of brush 13A (see Figs. 9
10 to 12), that of the other brushes being identical. The system includes the fact that the brush is fitted onto the shaft 23 by its cylindrical housing 16 which is approximately as long as the brush, and means for keying the body 14 of the brush to the supporting shaft 23 in the form of a pin 69, which is force-fitted into a transverse hole in the shaft 23, and of two diametrical seats 71
15 oriented at 90° to each other, one of which seats can be fitted, with an axial movement of the brush 13A, over the parts of said pin 69 that project from the shaft 23. The rapid shaft-hub connection system also includes a means for axially snap-locking the body of the brush to this shaft; this locking means comprises a slide 73 with an axial catch 75 able to move radially in guides 76
20 integral with the body 14 of the brush. The slide 73 is pushed elastically in a centripetal direction by a spring 77 so as to engage this catch 75 in a recess 79 in the shaft 23 when the brush 13A is fitted onto the shaft 23 and pushed back axially against the pin 69. The pin 69 is located toward the end of the brush nearest the bracket in order to avoid torsion in the part of the shaft 23
25 projecting beyond the pin, and the slide 73 is situated at the free end of said shaft in order to remain within reach so that the brush can be removed by overcoming the action of the spring 77 and displacing the slide as indicated by the arrow F100.

30 Provision is made for the use of a motor 35 for turning the brushes, of a type capable of turning in both directions of rotation, and for the use of a corresponding control circuit to enable the operator to reverse the direction of rotation of the brushes. The machine also includes a suction system that may be configured in two different possible suction circuits having in common an exhaustor 39, and a system for spraying water onto the
35 floor.

For the wet cleaning of floors, the suction circuit has a first configuration between first suction nozzles 41, 43 (Fig. 15) arranged externally and in the vicinity of the set of brushes and a tank 45 (Fig. 2) of

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used water, for sucking up the water sprinkled on the surface to be cleaned by a water spraying system comprising jets 47, 49 formed in tubes running the full width of the machine and each sited externally on opposite sides of the assembly of brushes and nozzles 41, 43. The exhauster 39 (Figs. 2, 3)
5 creates a depression in the tank 45 via a vertical suction pipe 39A inserted in a liquid-tight manner in a sleeve 45A forming part of the envelope of said tank of used water 45. The nozzles 41, 43 are connected together pneumatically by a horizontal pipe 51 (Fig. 15) and respective connections 53, 55 and to the tank 45 by a flexible pipe 57 that ends in the
10 tank with a vertical pipe 57A inserted in a liquid-tight manner in a sleeve 45B formed from the tank itself (Figs. 1 and 15).

For cleaning carpets and the like by a dry process, said suction circuit can be switched to a second configuration so that it extends between second suction nozzles 59, 61 (Figs 4 and 5) positioned centrally above the
15 set of brushes, and the tank 45. To this end the upper wall of the pipe 57 (Fig. 1) contains a nozzle 57C that can be closed by a cap 57E, when said first configuration of the suction circuit is being used; when said second configuration of the suction circuit is in use, the nozzle 57C is connected via a filter 63 (Fig. 4) to said second nozzles 59, 61 to collect the dust raised by
20 the dry-running brushes.

The nozzle 57C may also be connected via a hose to a suction nozzle that can be moved by hand relative to the machine and is not shown in the drawing, for collecting dust, liquids and the like around the machine itself.

25 When using the first configuration of the suction circuit for wet cleaning, the pairs of brushes 13A, 13B; 15A, 15B are rotated in the direction of arrows F1, F2, respectively (Fig. 15), in order to throw the cleaning water toward the respective nozzles 41, 43. When using the second configuration of the suction circuit for cleaning in the dry state, however, the rotary motion
30 of the brushes is reversed by said motor 35 control circuit so as to turn them in the opposite direction to the arrows F1, F2, causing the dust to be thrown up toward the second nozzles 59, 61, and these nozzles create a depression and suck the dust into the filter 63.

35 The water spraying system comprises an electric pump 65 (Figs. 1 and 3) of the type operated by an electromagnet and a pulse generating circuit (not shown in the drawing) for energizing the magnet, this circuit enabling the frequency of said pulses to be adjusted to a desired value to vary the output of the pump. The electric pump takes clean water from the

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bottom of the tank 2 through a tube 65A and, by means of a tube 65B and through a unit 67 in which the water is heated and/or vaporized, sends it to said jets 47, 49. Consequently by activating the pump 65 and optionally the heating unit, hot or cold water and/or steam can be sprayed onto the surface
5 that is to be cleaned. Said heating unit 67 (Figs. 6 and 7) comprises electrical resistors 68 in thermal contact with a coil 70 carrying the water. The coil 70 is formed by a groove on one face of a first metal plate 70A, a second metal plate 70B being placed liquid-tight against said face of the plate 70A. The electrical resistors 68 are applied to the outsides of the plates 70A, 70B.

10 The machine is powered by a plurality of on-board batteries 81, in this case four (Figs. 1 and 3), placed in an upward cavity defined by a wall 2B that closes the top of the clean water tank 2. This cavity forms a housing of the exact dimensions of said batteries, and said housing is covered at the top by the base 45C of the used water tank 45. This gives an extremely
15 compact, space-saving machine with its own self-contained power supply.

The machine is equipped with means for selectively raising and lowering, into contact with the ground, either of said first suction nozzles 41, 43 or for partially raising both of them simultaneously. In one embodiment, these means comprise two linkages 83, 85 (Figs. 1, 2 and 3) arranged on the
20 sides of the machine and basically identical. These linkages comprise links 87, 89 from which respective nozzles 41, 43 are suspended, hinged to respective pivoting sector links 91, 93 attached to respective transverse shafts 91A, 93A. Also hinged to the sector links are rods 95, 96 (for linkages 83, 85, respectively) connecting the sector links together. The linkage 85 has
25 an expansion 97 in the rod 96 containing a slot 99. The vertical sides of said slot are connected kinematically to an eccentric disk 101, which disk can be turned through 180° about a horizontal axis X-X by a geared motor 103 mounted on the vertical plate 7 by brackets (not shown in the drawing). By rotating, the eccentric disk 101 effects in alternation, by the horizontal sliding
30 of the rod 96, a raising of one nozzle and a lowering of the other into respective positions of maximum raising (Fig. 16A) and maximum lowering (Fig. 16C). More specifically, because these nozzles 41, 43 are intended for wet cleaning the floor, it is advisable that the foremost nozzle with respect to the translational motion of the machine, e.g. nozzle 41 with respect to the
35 direction of movement indicated by arrow F4 in Fig. 16, be raised to allow the water sprayed by the jets 47, 49 to come into contact with the brushes, and that the rear nozzle 43 be lowered to suck the water up and leave the floor more or less dry.

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For the purpose of automatically reversing the positions of the nozzles 41, 43 when the machine reverses its direction of movement, the machine includes a sensor for sensing the direction of forward travel of the machine: this consists of a component 105 (Fig. 15) that pivots between two stops 105A, 105B hinged coaxially to a machine support wheel 6A and held against it for friction purposes by a spring (not shown in the drawing). Said component is moved by the friction of the wheel 6A between the stops 105A and 105B depending on the direction of rotation of said wheel, throwing one or other of the microswitches 107, 108 in the process. This throwing of the switches causes the output shaft of the geared motor 103 to rotate through 180°, thereby reversing the positions of the nozzles. Furthermore the output shaft of the geared motor 103 can be turned through only 90°; the eccentric disk 101 then assumes an intermediate position in which both nozzles 41, 43 are partially raised off the surface that is to be cleaned (Fig. 16B), e.g. for dry operation of the machine using said second suction circuit or to allow the use of a suction nozzle separate from the machine.

The linkage controlling the nozzles 41, 43 includes articulation slots 91B, 93B (Fig. 2) formed in the sector links 91, 93 holding pins force-fitted into each end of the rod 95. These pins and slots thus form loose hinges within the linkage to allow further raising of the lowered nozzle when the nozzle encounters obstacles or irregularities in the surface being cleaned. Once over the obstacle, gravity will pull the nozzle back down to follow the surface being cleaned.

In a second embodiment of the invention, said means for raising the nozzles 41, 43 comprise, close to one side of the machine, two adjacent cams 205, 207 (see Figs. 17 and 18) attached to the output shaft of the actuator 103 and, for each nozzle 41, 43, a linkage formed by a link 187, 189 and by first and second rockers 191, 193; 195, 197, the first rockers being attached to said transverse shafts 91A, 93A and the second rockers being pivoted on axes 193A, 197A parallel to the axis X-X of the actuator. The rockers of each pair are connected to each other at one end by means of a pin 199 driven into the second rocker 193, 197 and inserted with a small degree of play in a slot in the first rocker 191, 195, while the other end of each first rocker 191, 195 is connected to its respective link 197, 189 by a pin 200 and a slot 187A, 189A that allows its respective nozzle 41, 43 to rise when it encounters an obstacle. Under the action of respective springs 201, 203, the second rockers 193, 197 press their free ends elastically against the respective cams 205, 207. On the other side of the machine, for each nozzle

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41, 43 the linkage comprises only one rocker (not shown in the drawing) similar to said first rocker 191, 193, attached to the respective transverse shaft 91A, 93A, and a similar link to the link 187, 189.

5 The profiles of said cams are designed to produce, depending on the angular position of the output shaft of the actuator 103 to which they are attached, four combinations of positions of the nozzles 41, 43. In particular, in Fig. 17 both nozzles are raised clear of the surface on which the machine is standing, as for example to move the machine from one location to another. By turning the cams in the direction of arrow F202 through an angle
10 A, both nozzles are lowered to a maximum extent and brought into contact with the surface to be cleaned, e.g. in order to suck up water lying on the surface. Upon further rotation through an angle B, nozzle 41 will be raised and nozzle 43 lowered, and upon further rotation through an angle C, the positions of the nozzles will be reversed. When the machine is operating in
15 the wet cleaning mode, the actuator 103 alternates the latter two positions depending on the direction in which the machine is advancing, in much the same way as was described with regard to the first embodiment of the nozzle raising device.

Provision is made for the automatic interruption of suction in either
20 or both nozzles 41, 43 when they are raised off the surface undergoing cleaning. To bring this about, the connections 53, 55 between the nozzles 41, 43 and the piping 51 of the suction circuit include an intermediate flexible length 53A, 55A situated below and in the vicinity of a respective abutment formed by the shafts 91A, 93A that turn the pivot links of the linkages. When
25 the nozzle 41 or 43 is in the lowered position in contact with the floor (Fig. 16C), said flexible part 53A of the connection 53 is open, allowing the suction to draw up the used water from the floor. When, on the other hand, the nozzle 41 and/or 43 is raised either to an intermediate position (Fig. 16B), or completely (Fig. 16A), the flexible length 53A of the connection is obstructed,
30 having been squashed by the raising of the nozzle against the respective shaft 91A, 93A. By this means the suction is concentrated only in the nozzle that is in contact with the floor and so is not wasted.

It will be understood that the drawing shows only an example provided purely as a practical demonstration of the invention, it being
35 possible for the invention to be altered as regards shapes and arrangements without thereby departing from the scope of the concept on which the invention is based. The presence of any reference numerals in the accompanying claims is for the purpose of facilitating the reading of the

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claims with reference to the description and drawing, and does not limit the scope of protection represented by the claims.

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CLAIMS

1. A machine for the wet cleaning of floors, comprising a system for dispensing cleaning water, characterized in that said water dispensing
5 system comprises a variable-delivery dispensing pump (65) and a unit (67) for heating the dispensed water so that heated or unheated water and/or steam is dispersed through jets (47, 49) onto the surface to be cleaned.
2. Machine as claimed in claim 1, characterized in that said heating
10 unit (67) comprises at least one electrical resistor (68) in thermal contact with a coil (70) carrying the water.
3. Machine as claimed in claim 2, characterized in that said coil (70) is arranged between two metal plates (70A, 70B), to the outsides of which said electrical resistors are applied.
4. Machine as claimed in claim 3, in which said coil is made in the
15 form of a continuous groove on one face of one of said plates (70A).
5. Machine as claimed in any one of the preceding claims, characterized in that said pump is operated by an electromagnet via an electronic circuit capable of supplying pulses of current at a variable predetermined frequency to the electromagnet.
- 20 6. A machine for the cleaning of floors and/or carpets, rugs or the like; the whole as described above and as illustrated by way of example in the accompanying drawing.

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FIG.1

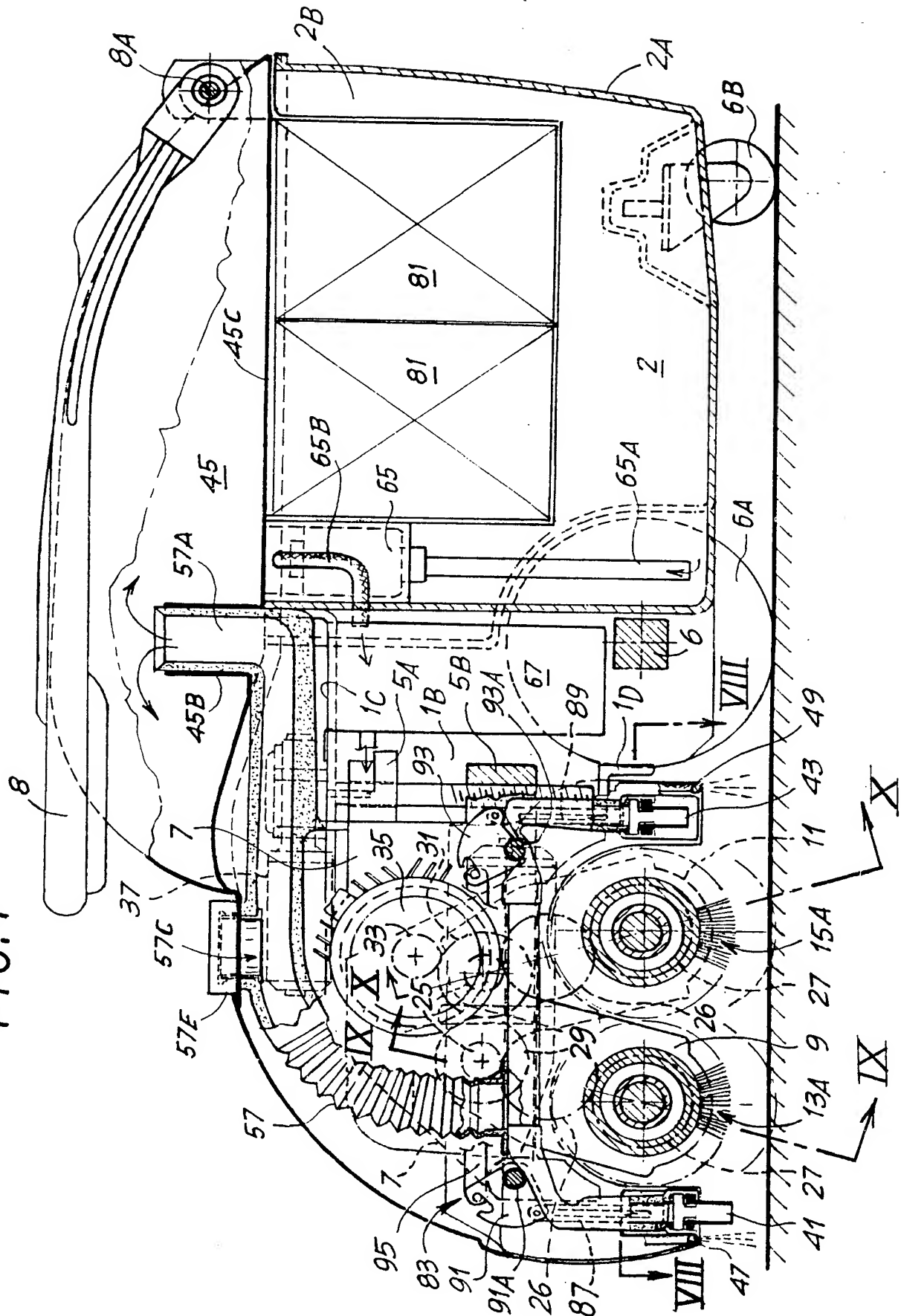
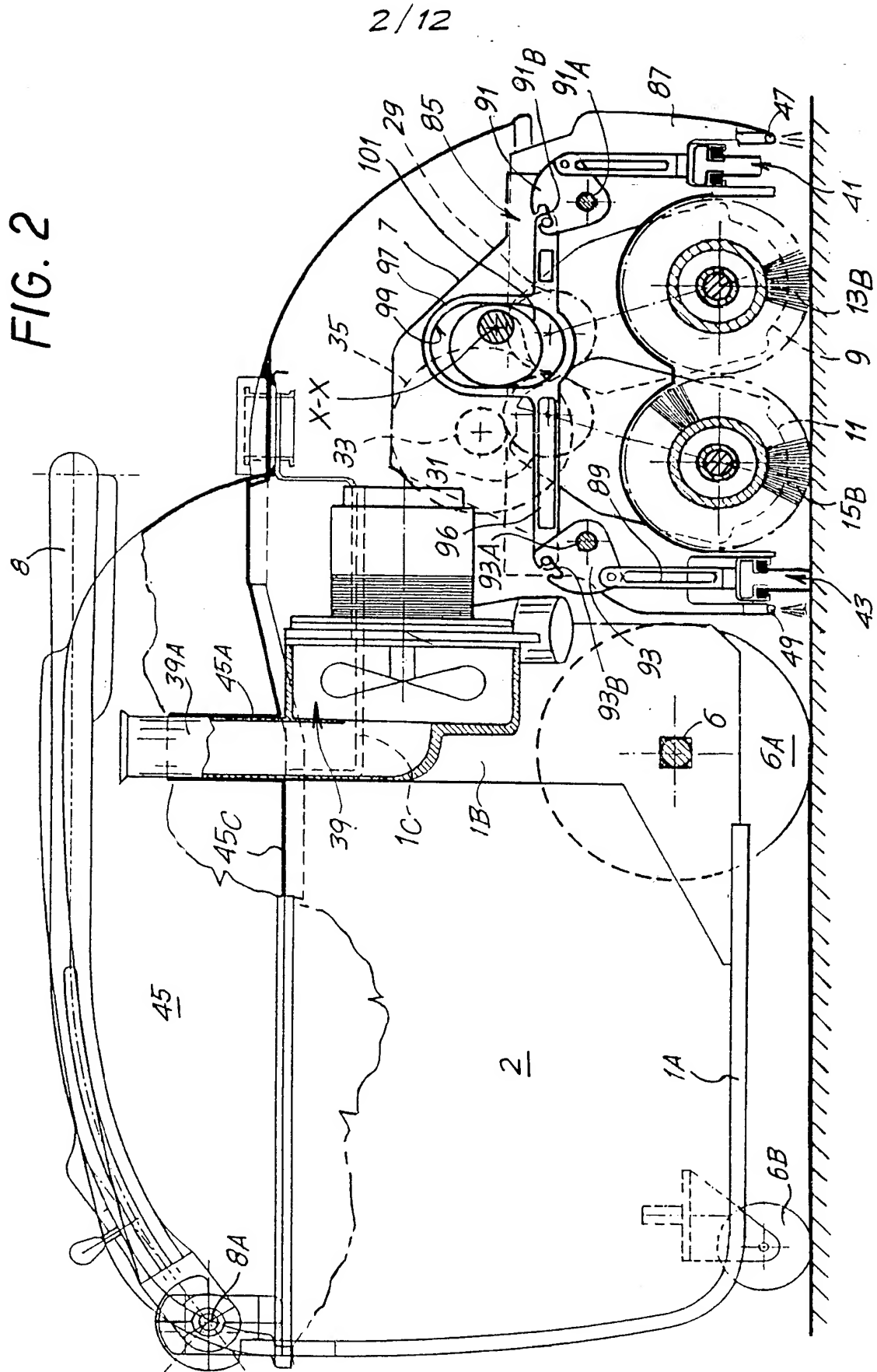
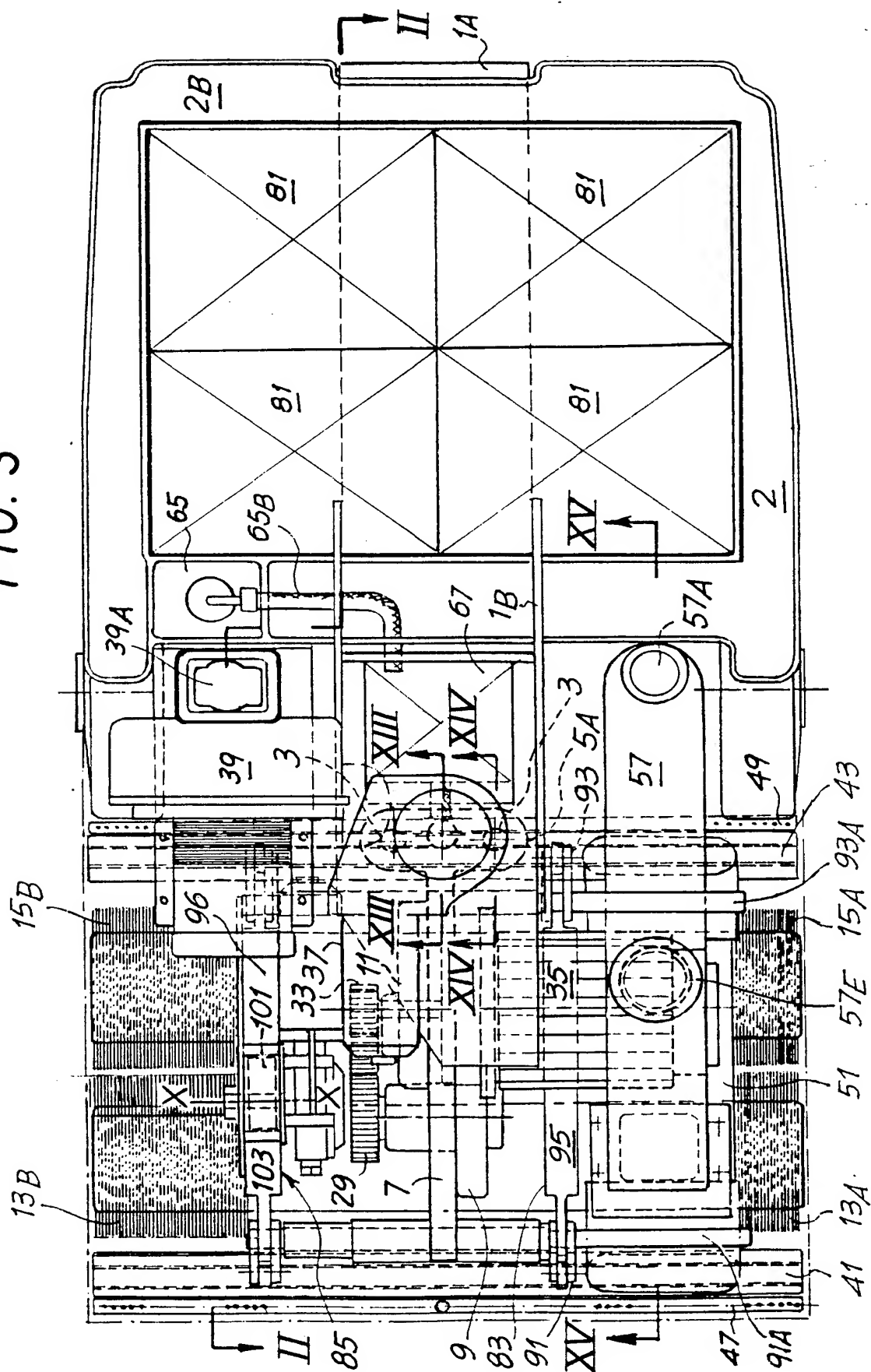


FIG. 2

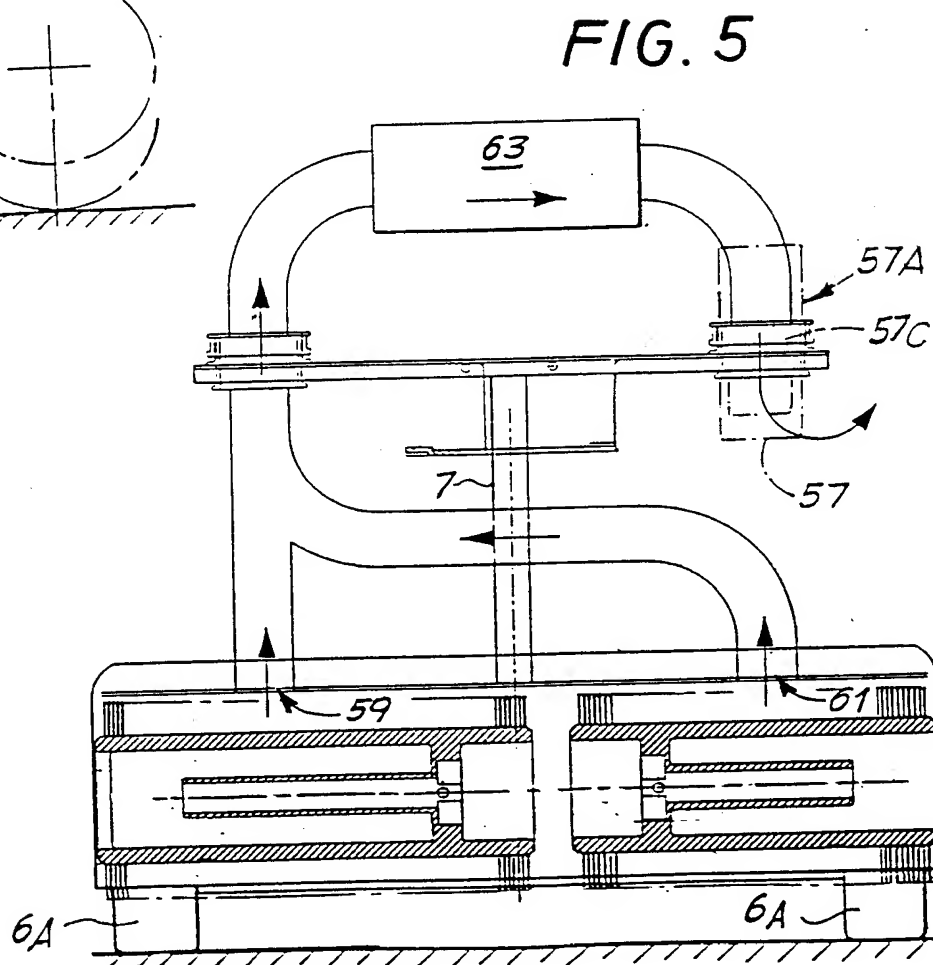
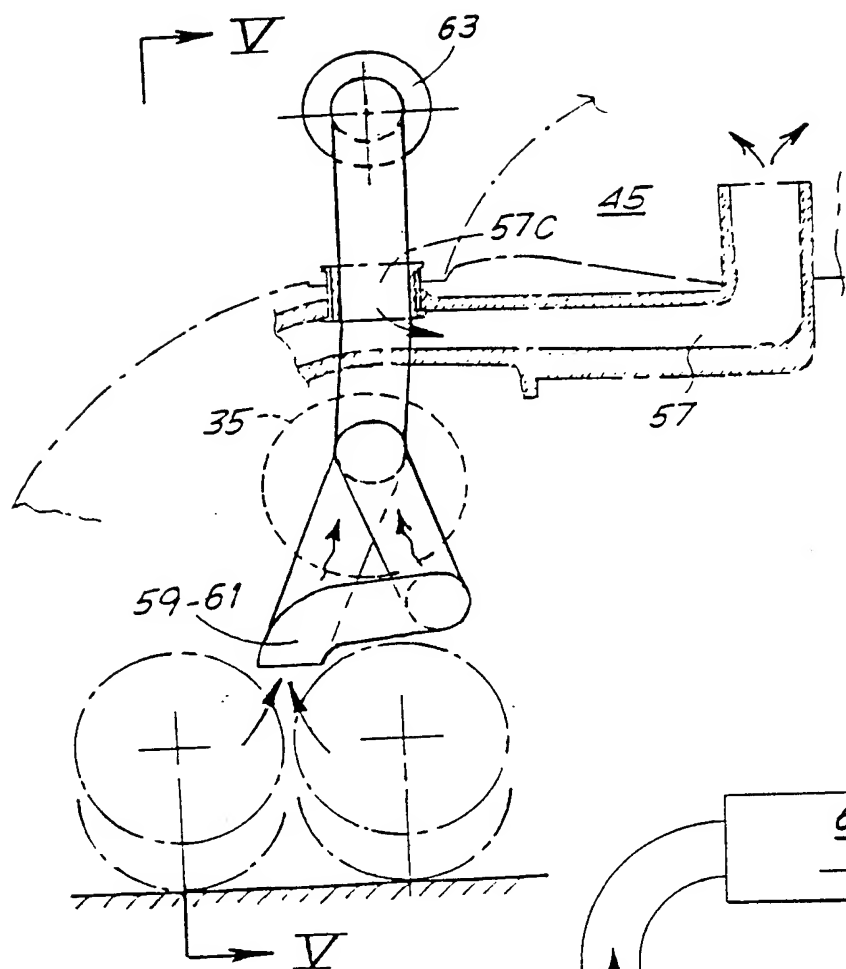


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FIG. 3



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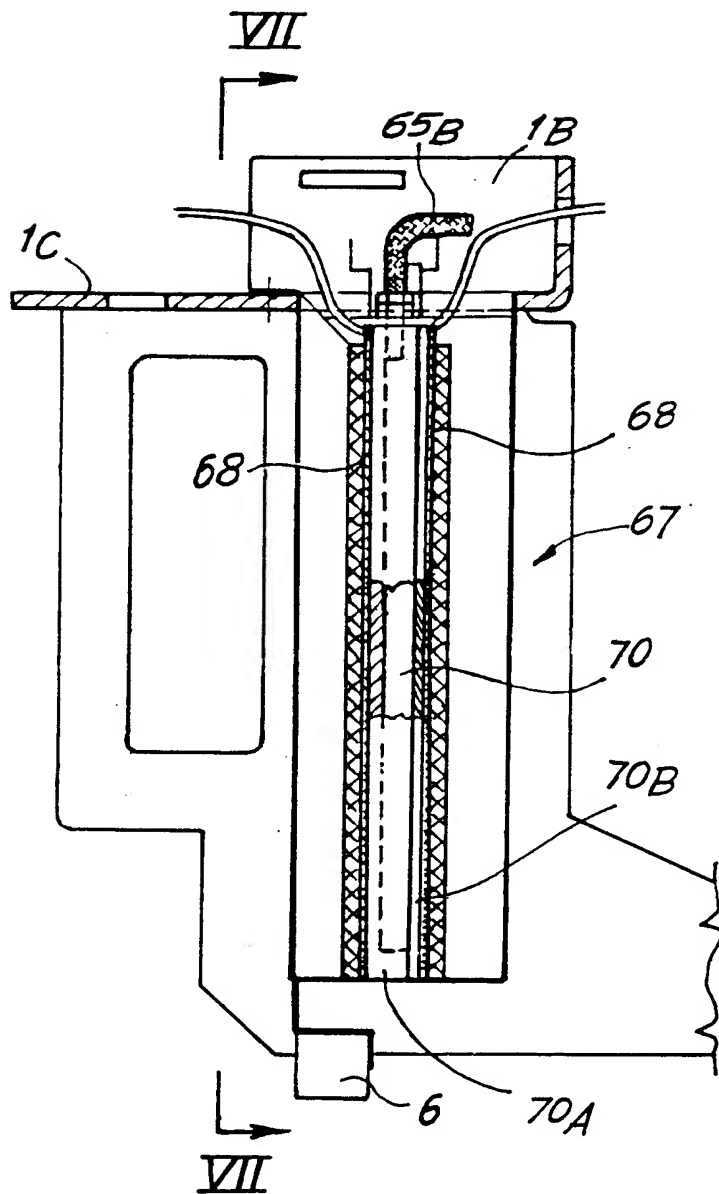


FIG. 6

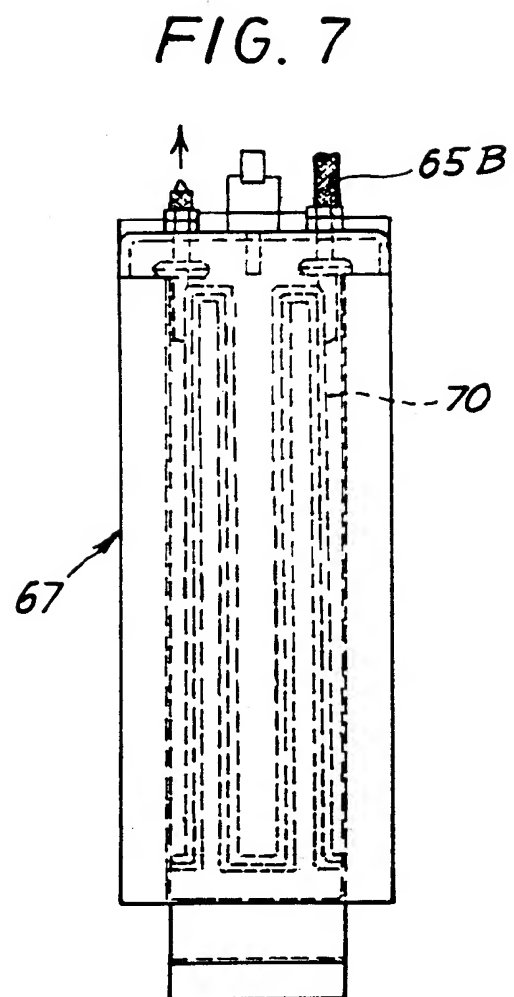
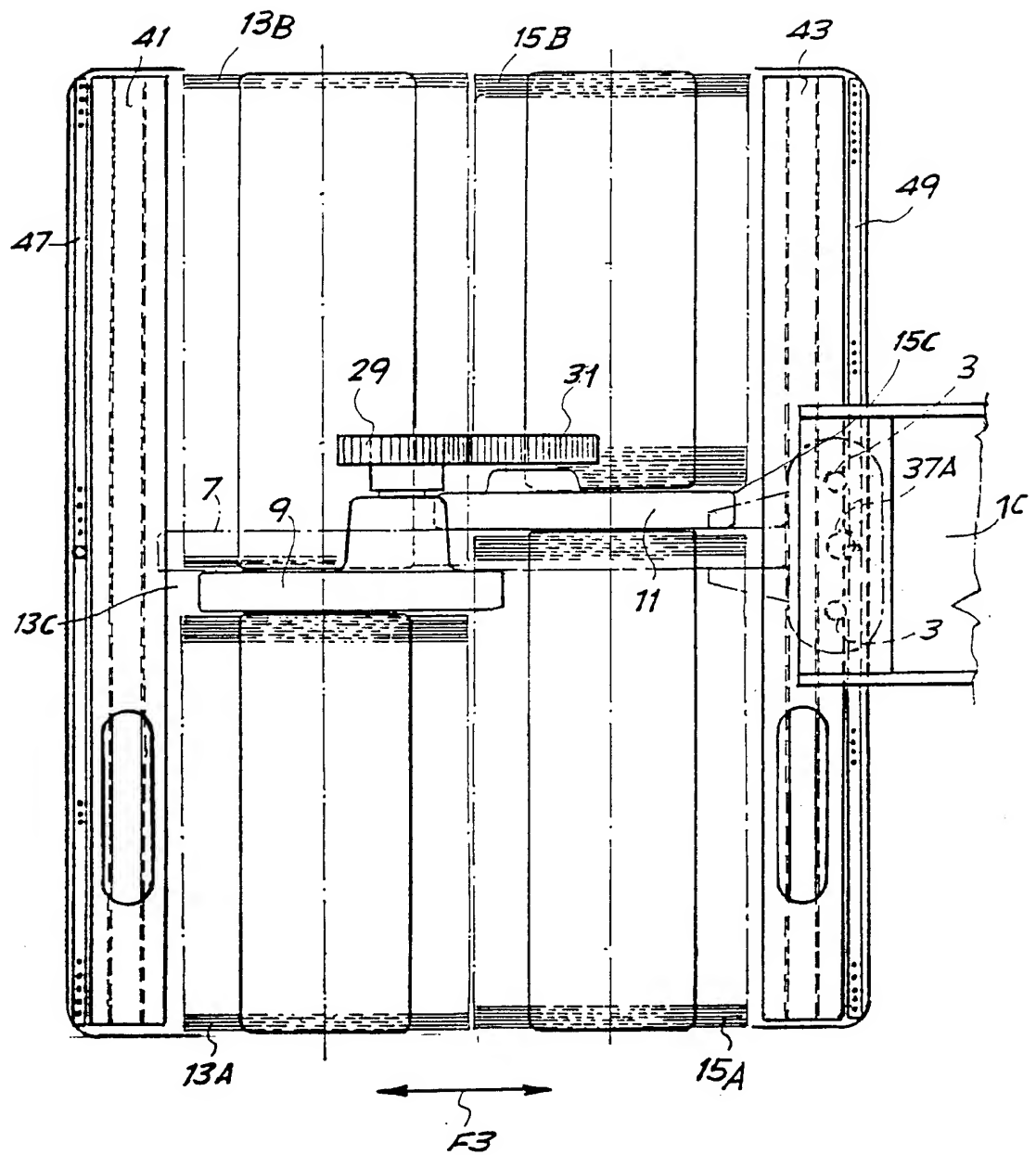


FIG. 7

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FIG. 8



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FIG. 9

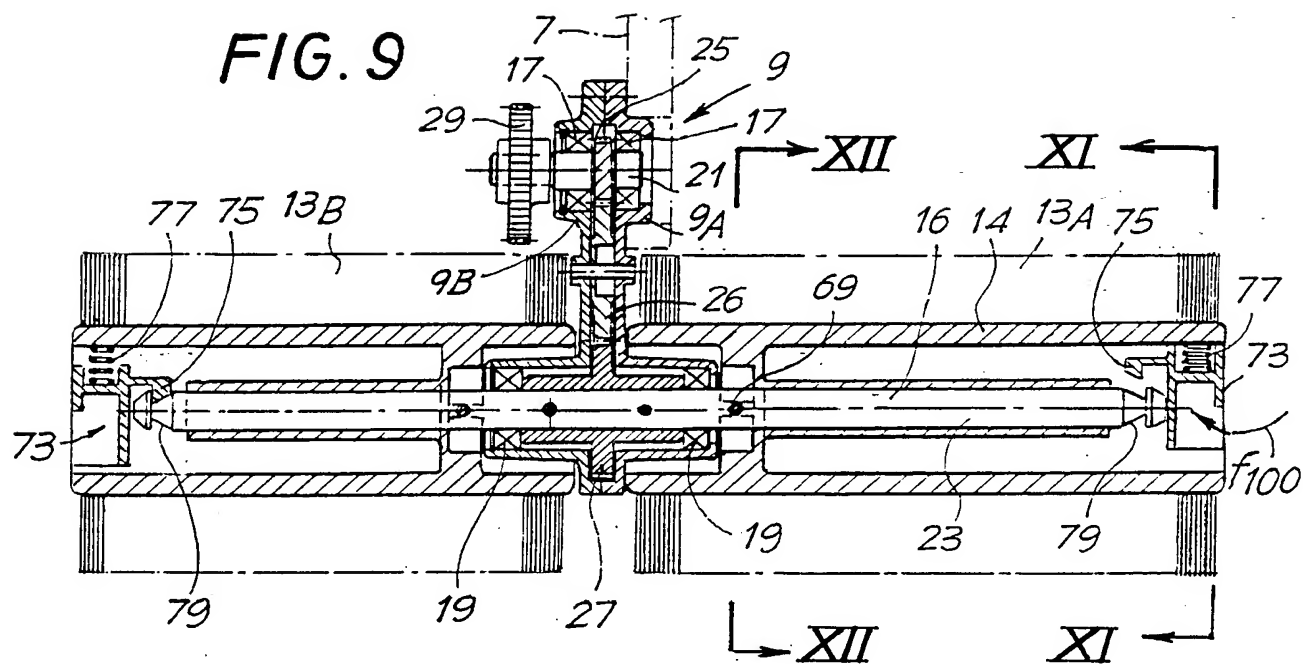


FIG. 10

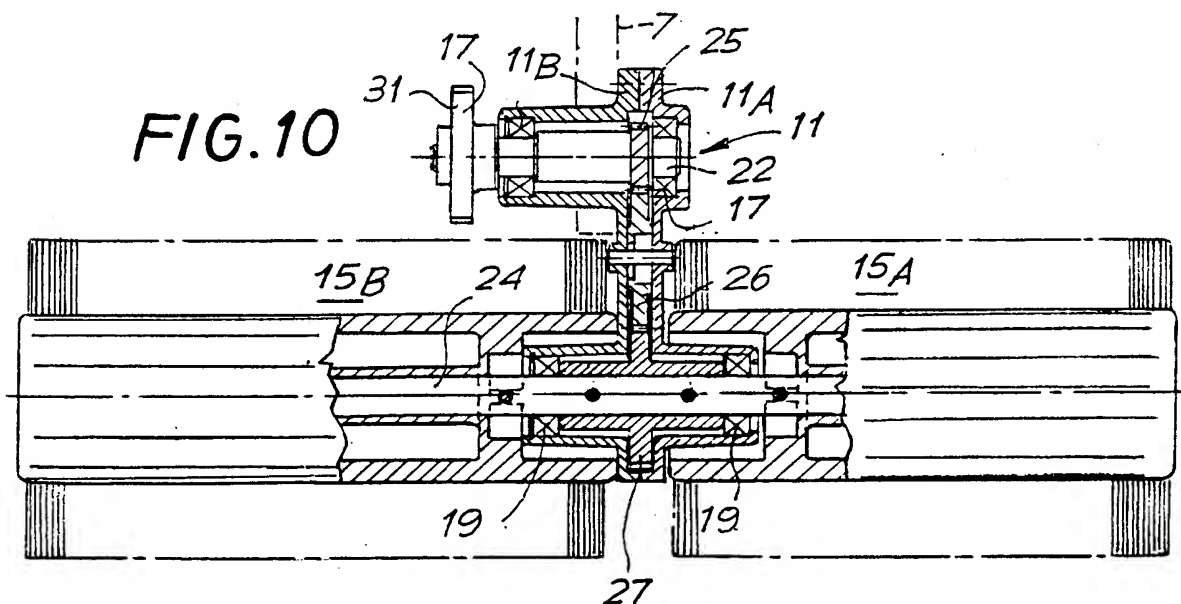


FIG. 11

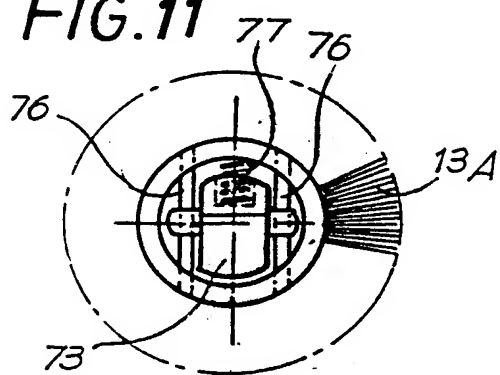
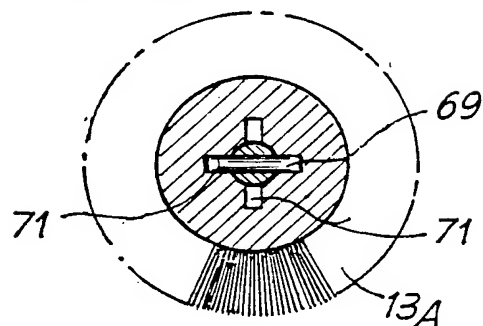


FIG. 12



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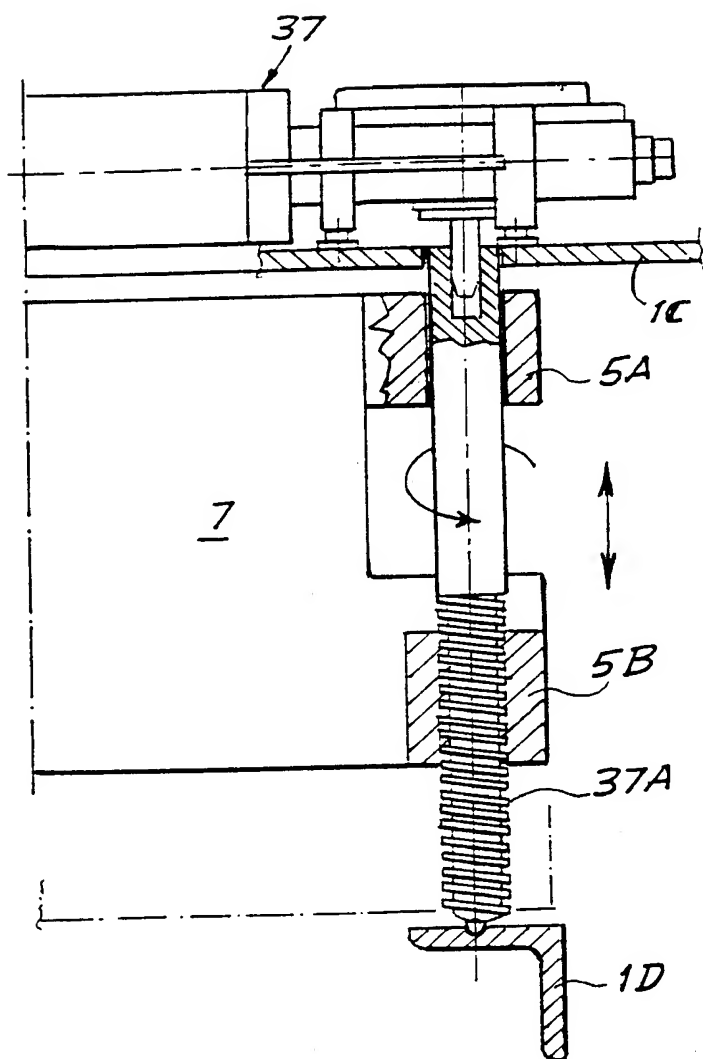


FIG. 13

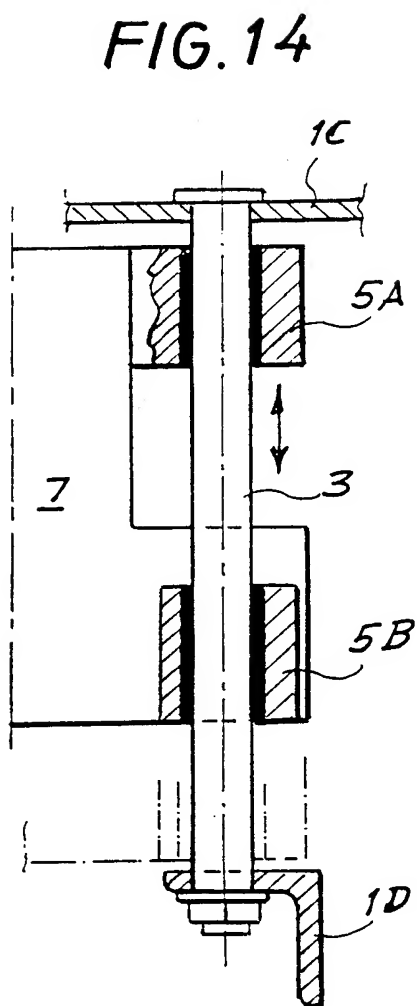
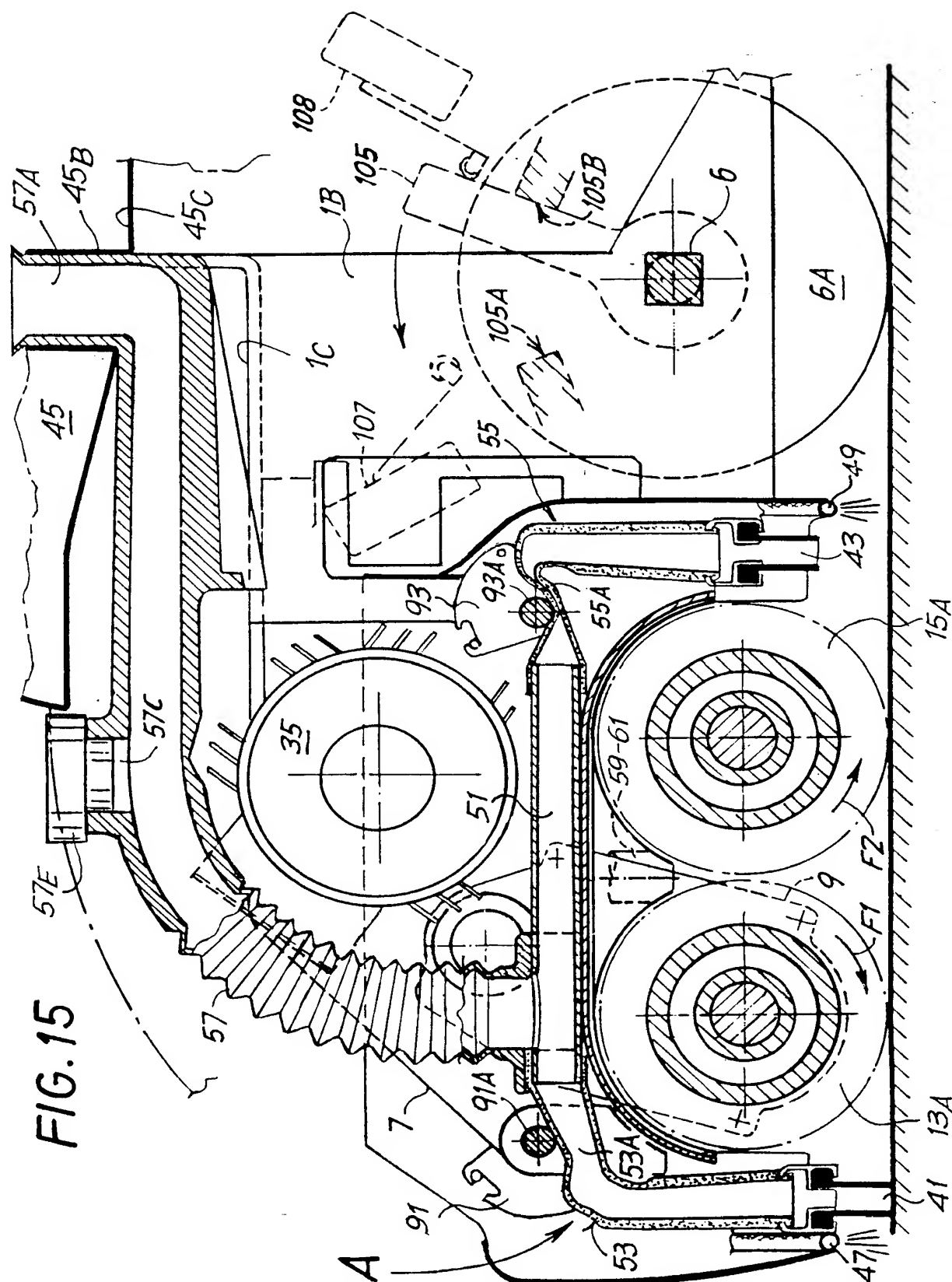


FIG. 14

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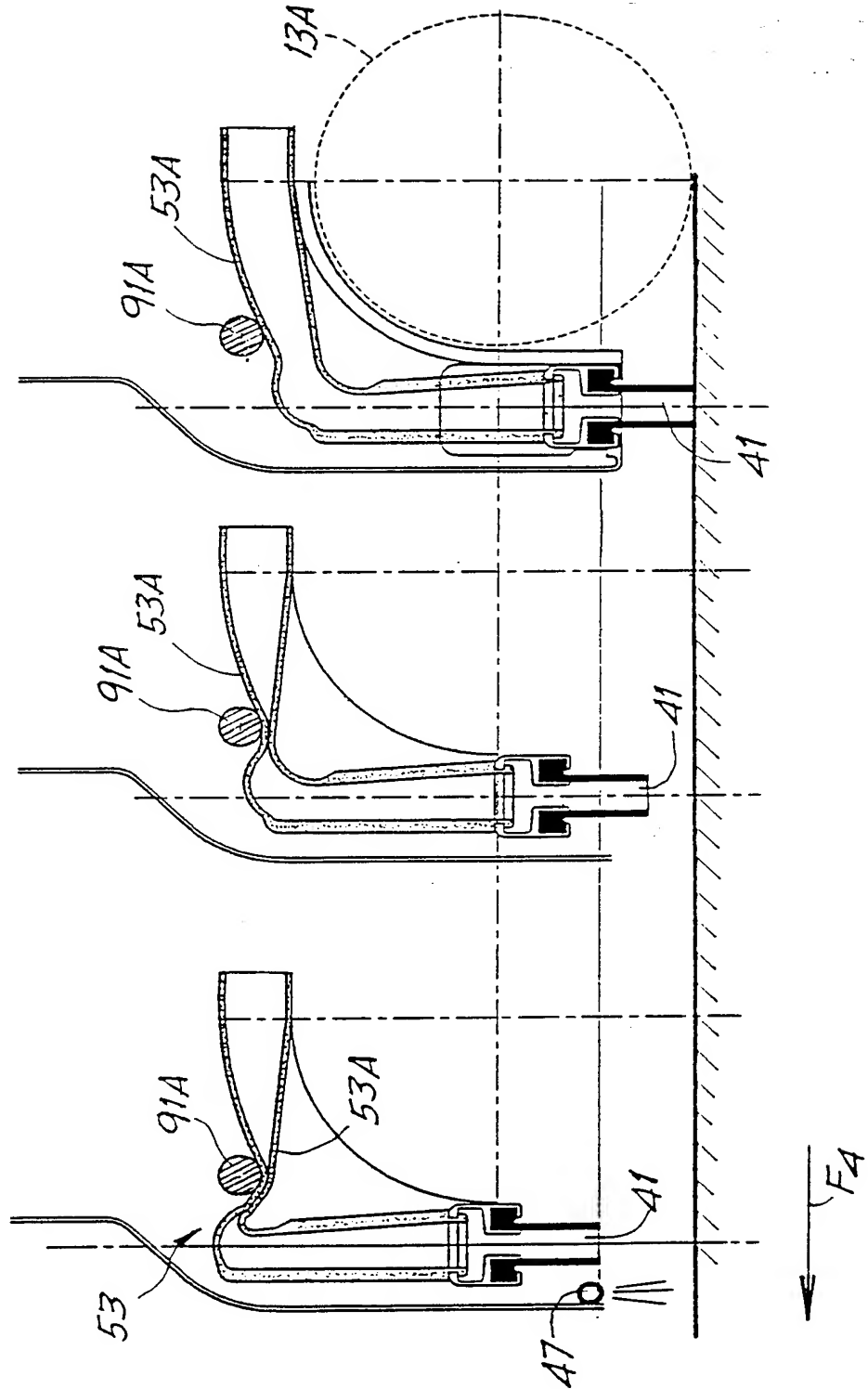


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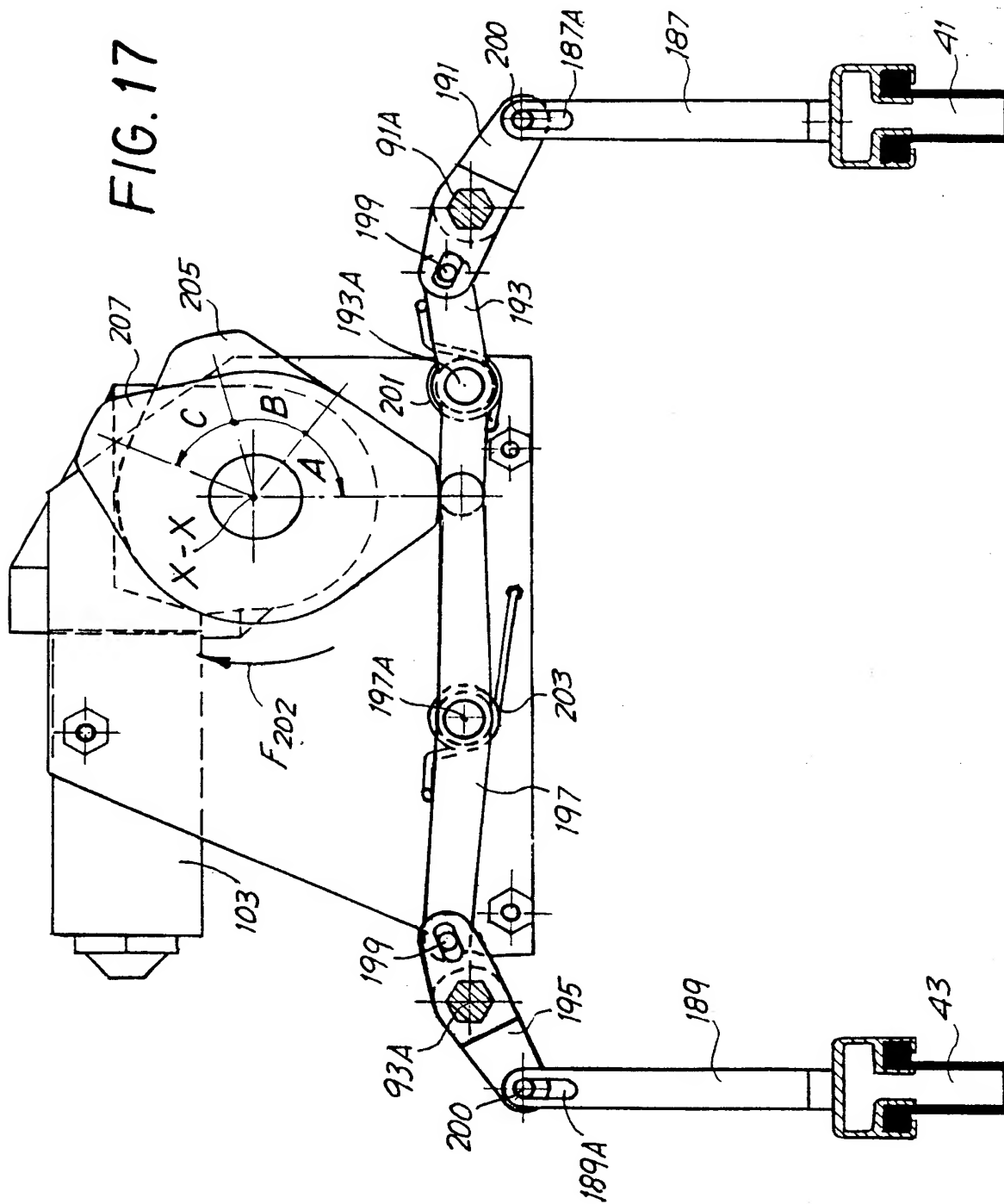
FIG. 16C

FIG. 16B

FIG. 16A

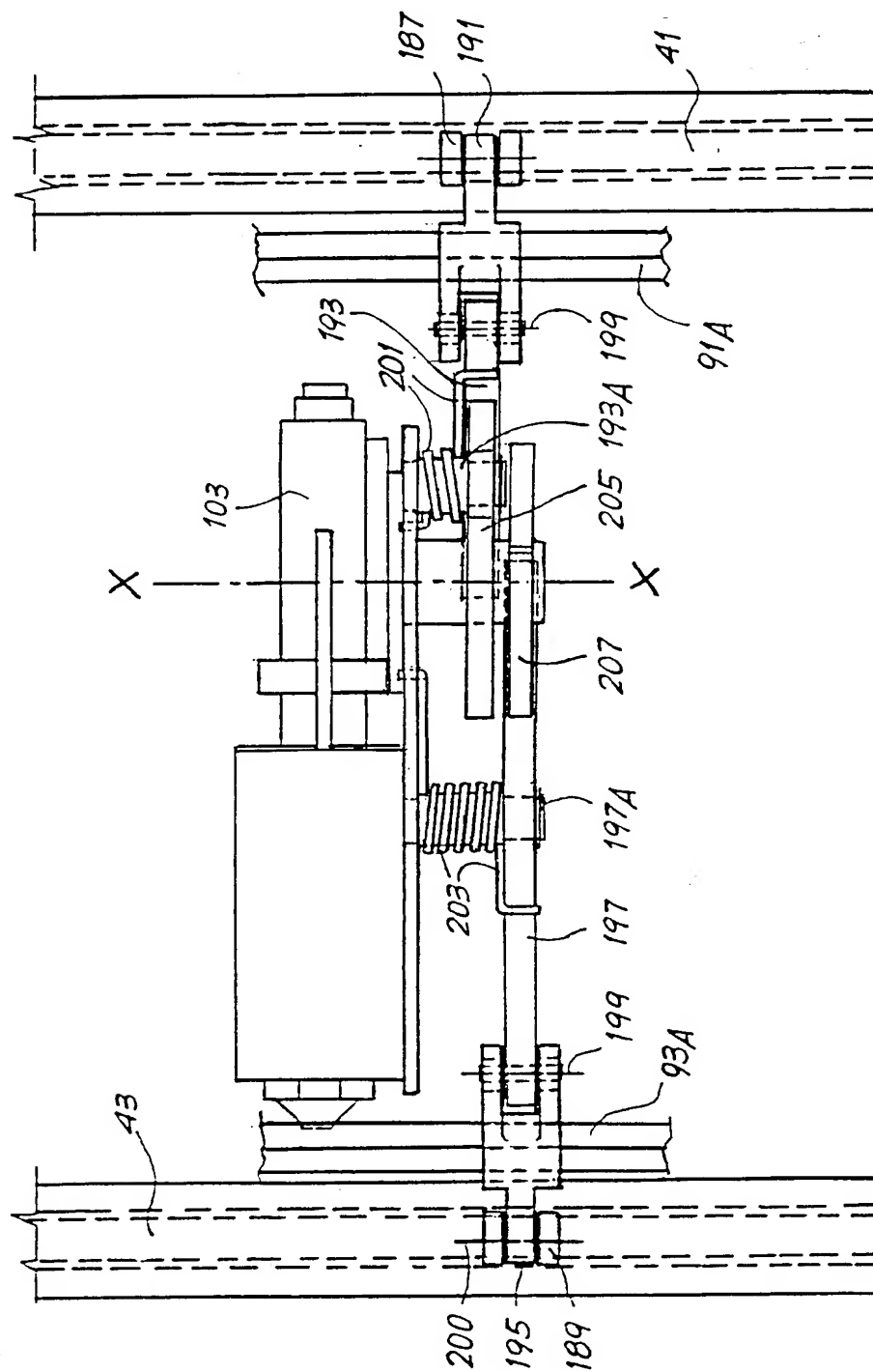


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FIG. 18



INTERNATIONAL SEARCH REPORT

International Application No

PCT/IT 98/00101

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A47L11/03 A47L11/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 295 244 A (TENNANT) 20 October 1981 see column 9, line 35 - column 10, line 9; figures 9-11 ---	1,2
Y	US 4 308 636 A (JOHN W. DAVIS) 5 January 1982 see column 4, line 39 - column 6, line 31; figures 1-6 ---	1,2
A	US 5 287 588 A (BERNARD GURSTEIN) 22 February 1994 see the whole document ---	1,2
A	FR 2 530 135 A (AUBRET) 20 January 1984 see the whole document -----	1,5

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

12 August 1998

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INTERNATIONAL SEARCH REPORT

Inter. Patent Application No

PCT/IT 98/00101

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4295244 A	20-10-1981	US 4194263 A CA 1161608 A US 4377017 A	25-03-1980 07-02-1984 22-03-1983
US 4308636 A	05-01-1982	NONE	
US 5287588 A	22-02-1994	NONE	
FR 2530135 A	20-01-1984	NONE	